Claims

1. A photoluminescent article, comprising:

at least one host material; and

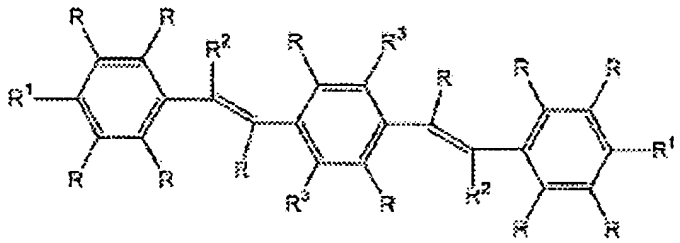
at least one color tunable photoluminescent dye, wherein the emission spectrum of the at least one tunable photoluminescent dye is dependent on the supramolecular architecture of the article.

2. The article of claim 1, wherein a photoluminescent emission spectrum of the dye is capable of being shifted by subjecting the article to mechanical deformation.

3. The article of claim 1, wherein a photoluminescent emission spectrum of the dye is capable of being shifted by subjecting the article to at least one of the stimuli selected from the list of mechanical deformation, temperature change, aging of the article, pressure change, exposure to a chemical compound.

4. The article of claim 1, wherein the color tunable photoluminescent dye is an oligo(phenylene vinylene) compound.

5. The article of claim 4, wherein the oligo(phenylene vinylene) is of the formula:



where each R^2 may be individually selected from a cyano, halogen, Cl, F, Br, C(=O)R, C(=O)OR, $C(=O)NR_2$, CF_3, CN, $S(O)_2OH$, NO_2, and N^+R_4, H, straight chain, branched or cyclic saturated alkyl, alkenyl, or alkynyl, hydroxy alkyl, carboxy alkyl, aryl, or substituted aryl, alkyloxy, methoxy, and ethoxy; and R^1, and R^3 may be selected from H, straight chain, branched or cyclic saturated alkyl, alkenyl, or alkynyl, hydroxy alkyl, carboxy alkyl, aryl,

or substituted aryl, alkyloxy, methoxy, ethoxy, cyano, halogen, Cl, F, Br, $C(=O)R$, $C(=O)OR$, $C(=O)NR_2$, CF_3, CN, $S(O)_2OH$, NO_2, and N^+R_4.

6. The article of claim 5, wherein each R is independently selected from H, straight chain, branched or cyclic saturated alkyl, alkenyl, or alkynyl, hydroxy alkyl, carboxy alkyl, aryl, or substituted aryl, methoxy, and ethoxy.

7. The article of claim 1, wherein a portion of the color tunable photoluminescent dye forms excimers, wherein the excimers emit a different emission spectrum than a portion of the color tunable photoluminescent dye not forming an excimer.

8. The article of claim 7, wherein the ratio of the portion of the photoluminescent dye forming excimers to the portion of the photoluminescent dye not forming an excimer depends on the supramolecular architecture the photoluminescent dye in the article.

9. The article of claim 1, further comprising a solvent.

10. The article of claim 1, wherein the solvent at least one of ethers, cyclic ethers, C_5 -C_{10} alkanes, C_5 -C_8 cycloalkanes which may be substituted with from 1 to 3 C_1 -C_4 alkyl groups, aromatic hydrocarbon solvents, such as toluene, halogenated hydrocarbon solvents, such as trichloromethane, acetonitrile, dimethylformamide, mixtures of such solvents, and supercritical solvents, CO_2, C_1 -C_4 alkanes in which any H may be replaced with F, compounds of the formula R_4 OR_5, in which each of R_4 and R_5 is independently an alkyl group of from 1 to 6 carbon atoms which may be further substituted with a C_1 -C_4 -alkoxy group, when one of R_4 and R_5 is methyl, the other of R_4 and R_5 is alkyl of from 4 to 6 carbon atoms or C_1 -C_4 -alkoxyethyl, diethyl ether, diphenyl ether, ethyl propyl ether, dipropyl ether, methyl t-butyl ether, di-t-butyl ether, dimethoxyethane, diethylene glycol dimethyl ether, cyclic ethers, THF, dioxane, aromatic hydrocarbon solvents, benzene, toluene, o-xylene, m-xylene, p-xylene, any isomer or mixture of isomers of cumene, halogenated hydrocarbon solvents, CH_2Cl_2, $CHCl_3$, 1,2-dichloroethane and benzene substituted from 1 to 6 times with fluorine and/or chlorine.

11. A material, comprising:

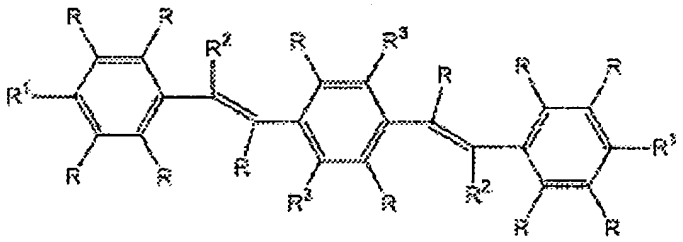
at least one host material; and

at least one color tunable photoluminescent dye, wherein the emission spectrum of the at least one tunable photoluminescent dye is dependent on the supramolecular architecture of the material.

12. The material of claim 11, wherein a photoluminescent emission spectrum of the dye is capable of being shifted by subjecting the article to at a mechanical deformation, a temperature change, aging of the article, a pressure change, exposure to a chemical compound.

13. The material of claim 11, wherein the color tunable photoluminescent dye is an oligo(phenylene vinylene) compound.

14. The material of claim 13, wherein the oligo(phenylene vinylene) is of the formula:



where each R^2 may be individually selected from a cyano, halogen, Cl, F, Br, C(=O)R, C(=O)OR, $C(=O)NR_2$, CF_3, CN, $S(O)_2OH$, NO_2, and N^+R_4; and R^1, and R^3 may be selected from H, straight chain, branched or cyclic saturated alkyl, alkenyl, or alkynyl, hydroxy alkyl, carboxy alkyl, aryl, or substituted aryl, methoxy, and ethoxy.

15. The material of claim 14, wherein each R is independently selected from H, straight chain, branched or cyclic saturated alkyl, alkenyl, or alkynyl, hydroxy alkyl, carboxy alkyl, aryl, or substituted aryl, methoxy, and ethoxy.

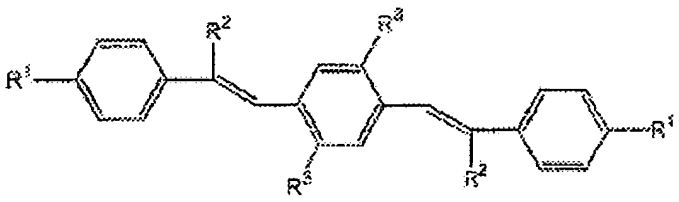
16. The material of claim 11, wherein a portion of the color tunable photoluminescent dye forms excimers, wherein the excimers emit a different emission spectrum than a portion of the photoluminescent dye not forming an excimer.

17. The material of claim 16, wherein the ratio of the portion of the photoluminescent dye forming excimer to the portion of the photoluminescent dye not forming an excimer depends on the supramolecular architecture the photoluminescent dye in the article.

18. The material of claim 11, further comprising a solvent.

19. The material of claim 11, wherein the solvent at least one of ethers, cyclic ethers, C_5-C_{10} alkanes, C_5-C_8 cycloalkanes which may be substituted with from 1 to 3 C_1-C_4 alkyl groups, aromatic hydrocarbon solvents, such as toluene, halogenated hydrocarbon solvents, such as trichloromethane, acetonitrile, dimethylformamide, mixtures of such solvents, and supercritical solvents, CO_2, C_1-C_4 alkanes in which any H may be replaced with F, compounds of the formula R_4 OR_5, in which each of R_4 and R_5 is independently an alkyl group of from 1 to 6 carbon atoms which may be further substituted with a C_1-C_4 -alkoxy group, when one of R_4 and R_5 is methyl, the other of R_4 and R_5 is alkyl of from 4 to 6 carbon atoms or C_1-C_4 -alkoxyethyl, diethyl ether, diphenyl ether, ethyl propyl ether, dipropyl ether, methyl t-butyl ether, di-t-butyl ether, dimethoxyethane, diethylene glycol dimethyl ether, cyclic ethers, THF, dioxane, aromatic hydrocarbon solvents, benzene, toluene, o-xylene, m-xylene, p-xylene, any isomer or mixture of isomers of cumene, halogenated hydrocarbon solvents, CH_2Cl_2, $CHCl_3$, 1,2-dichloroethane and benzene substituted from 1 to 6 times with fluorine and/or chlorine.

20. A photoluminescent dye of the formula:



where R^2 is an cyano, halogen, Cl, F, Br, C(=O)R, C(=O)OR, $C(=O)NR_2$, CF_3, CN, $S(O)_2OH$, NO_2, and N^+R_4, R^1 is alkoxy, methoxy, ethoxy group and R^3 may be any group which affects the desired physical or electronic properties of the compound selected from H, straight chain, branched or cyclic saturated alkyl, alkenyl, or alkynyl, hydroxy alkyl, carboxy alkyl, aryl, or substituted aryl, alkoxy, methoxy, and ethoxy.

21. The photoluminescent dye of claim 20, wherein the photoluminescent dye is one of 1,4-Bis-(α-cyano-4-methoxystyryl)-benzene, 1,4-bis-(α-cyano-4-methoxystyryl)-2,5-dimethoxybenzene, and 1,4-bis-(α-cyano-4-(2-ethylhexyloxystyryl)-2,5-dimethoxybenzene and 2,5-bis-(α-cyano-4-methoxystyryl)-thiophene.

22. A method of determining a degree of mechanical deformation, a temperature change, aging of the article, a pressure change, exposure to a chemical compound on an article, comprising:

measuring the photoluminescent emission spectra of an article comprising at least one host material and at least one color tunable photoluminescent dye, wherein the emission spectrum of the at least one tunable photoluminescent dye is dependent on the supramolecular architecture of the material; and

comparing the photoluminescent emission spectrum of the article with the photoluminescent emission spectrum prior to the mechanical deformation, a temperature change, aging of the article, a pressure change, exposure to a chemical compound.

23. The method of claim 22, wherein measuring the photoluminescent spectrum comprises visually inspecting the article.

24. The article of claim 1, wherein a difference between a maximum of the emission spectrum of the color tunable photoluminescent dye for a crystalline solid of the color tunable photoluminescent dye to a maximum of the emission spectrum for the molecular liquid solution is greater than 50 nm.

25. The article of claim 7, wherein a ratio of the photoluminescence intensity of the excimer portion to the photoluminescence intensity of portion not in an excimer is capable of changing by a factor of at least 3 after the article is subjected to at least one of mechanical deformation, temperature change, aging of the article, pressure change, and exposure to a chemical compound.

26. The article of claim 1, wherein the host material comprises a polymer.

27. The article of claim 26, wherein the polymer is at least one material selected from a polyolefin, polyethylene, linear low density polyethylene, low density polyethylene, high density polyethylene, ultra high molecular weight polyethylene, poly(propylene), cyclic olefin polymers and copolymers, poly(acrylate)s, polymethyl methacrylate, poly methacrylate, polybutyl acrylate, poly(acrylamide), poly(acrylonitrile), vinyl polymers, poly(vinylchloride), poly(vinylidenechloride), poly(vinylfluoride), poly(tetrafluoroethylene), poly(chlorotrifluoroethylene), poly(vinylacetate), poly(vinylalcohol), poly(2-vinylpyridine), poly(vinyl butyral), poly(styrene)s, copolymers, acrylonitrile butadiene styrene copolymer, ethylene vinyl acetate copolymers, polyamides, polyamide 6, 6,6, polyamide 12, polyamide 4,6, polyesters, poly(ethylene terephthalate), poly(butylene terephthalate), poly(ethylene naphthalate), poly(carbonate)s, polyurethanes, poly(aryl sulfones), poly(phenyleneoxide), thermoset resins, phenol formaldehyde resins, resoles, novolacs, epoxy resins, regenerated cellulose, cellophane, cellulose acetate, cellulose acetate butyrate, natural fibers, wool, silk, cotton, ramie, jute, starch-based materials, styrene-butadiene copolymers, polybutadiene, ethylene-propylene copolymers, polychloroprene, polyisoprene, nitrile rubbers, silicone rubbers, thermoplastic elastomers.